Remarks/Arguments

Background

Claims 7-21 are now pending. Claims 1-6 have been canceled. Claim 21 has been added. Support for claim 21 can be found *inter alia,* in original claim 7 and in Examples 1 and 2. No new matter has been added.

Claims 7-13 remain under consideration. Claim 7 is the sole independent claim. Claim 7 embraces a non-woven, wet laid fiber mat produced by dewatering an aqueous slurry of fibers. The fibers are bonded together with a cured binder composition that comprises a urea-formaldehyde (UF) resin modified with a protein. The protein is provided in an amount of 0.1% to 10% by weight of the UF resin and protein solids.

The Rejections

I. Claims 7-9 and 11-12 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Pub. Appln. 2003/0099850 (Belmares).

II. Claims 7-9 and 11-13 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,384,116 (Chan) in further view of U.S. Pub. Appln. 2003/0099850 (Belmares).

III. Claim 10 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Pub. Appln. 2003/0099850 (Belmares) as applied to claim 9 above, and further view of WO 01/59026 (Trocino).

These rejections are respectfully traversed.

At the outset, it is observed that the current rejections are very similar to the rejections that were withdrawn in the Office Action of August 4, 2005. It is regrettable that it took a full year to return to the same issues.

Rejection I is traversed as follows:

For a reference to anticipate a claimed invention, the reference must teach **each and every** limitation of the claimed invention. *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 58 USPQ2d 1286, 1291 (Fed. Cir. 2001).

Because the cited Belmares publication, at a minimum, is missing a key element of the claimed invention, the anticipation rejection must be withdrawn.

The present invention is based on the surprising discovery that the addition of a small amount of a protein additive into a conventional urea-formaldehyde resin binder for making ***non-woven, wet-laid fiber mats, especially a wet laid fiberglass mat***, has a strength enhancing effect on the wet laid fiber mat. This strength enhancing effect is analogous to that observed for the previously patented (and commonly owned) invention in which a small amount of a styrene-maleic anhydride (SMA) copolymer is added to such binders (see U.S. Patent 5,914,365 and its divisional U.S. Patent 6,084,021). Indeed, data in the subject application also shows that the combination of both a small amount of protein and a small amount of SMA is particularly and unexpectedly advantageous in such applications. New claim 21 is focused specifically on this particular combination.

The Belmares publication is directed to board or panel products and focuses on formaldehyde resins that are useful as board or panel coatings or as board binders that exhibit low formaldehyde emission. Belmares does not relate to the preparation of and thus does not describe a non-woven, wet laid fiber mat. Belmares boards and panels simply are not analogous to the non-woven, wet laid fiber mats embraced by the claims of the present invention.

A board or a panel is defined as a flat piece of wood or **similarly rigid material** adapted for a special use (emphasis added) (from www.dictionary.com). Belmares also refers to "composite panels" (p. 2, paragraph [0015] of Belmares), which a skilled worker would understand to be a flat piece of rigid material made by pressing together the composite constituents. Indeed, Belmares refers to the product as "building materials like boards made from mineral fiber, wood fiber, fiberglass, as well as particle board or plywood…" (p. 4, paragraph [0045] of Belmares).

In contrast, a mat is defined as a densely woven or thickly tangled mass: `a mat of hair.`, (again from www.dictionary.com). A non-woven, wet laid mat is thus a tangled mass of fibers formed simply by the deposition of the fibers from a slurry (see especially paragraph [22] of the subject application) and the claimed limitation to a "wet laid fiber mat produced by dewatering an aqueous slurry of fibers." No pressing is involved in the manufacturing of such fiber mat products and the mat is not rigid, as a board or composite panel inherently is.

As additonal evidence of the nature of applicants claimed product, reference is made to the patents cited in paragraph [04] of the subject application, all of which were previously cited in previously-filed Information Disclosure Statements filed. Reference also is made to U.S. Patent 5,914,365 and its divisional U.S. Patent 6,084,021, as well as U.S. Patent 6,384,116 (each of which also was similarly cited in an earlier submitted Information Disclosure Statement). As described in these references, wet laid fiber mats are prepared by dewatering a fiber slurry that has been deposited on a moving screen or cylinder, on which the fibers enmesh themselves into a freshly prepared wet glass fiber mat, to yield a sheet-like fiber mat simply by the removal of water, usually by suction and/or vacuum devices. Thereafter, an adhesive binder is applied to the dewatered mat. The adhesive binder is applied to the mat by soaking the mat in an excess of binder solution or suspension, or by impregnating the mat surface by means of a binder applicator, for example, by a roller coater, curtain coater, dip and squeeze application, or spray coater. Suction devices often are also utilized for further removal of water and excess binder and to ensure a thorough application of binder through the full thickness of the fiber mat. Both the method of manufacturing and the binder used are intended to produce a mat having a high degree of flexibility and tear strength, in addition to dry tensile and wet tensile properties.

As is apparent from these contrasting definitions, the panels and boards of Belmares, on the one hand, and the wet laid fiber mats of the present invention, on the other, do not refer to equivalent structures. A wet laid, non woven fiber mat thus is structurally very different from the composite panels and boards embraced by Belmares teachings. Panels and boards described by Belmares are prepared by consolidating the board materials under heat and considerable compaction pressure (though we note that Belmares' disclosure regarding the formation of the

boards and panels is sorely lacking). In contrast, wet laid mats of the present invention are un-compacted, relying principally on the dewatering of a fiber slurry to cause mat formation. A skilled worker simply would not find the teachings of Belmares aimed at composite panels and boards analogous to the very different wet laid mats to which the pending claims are directed.

Belmares fleeting reference to the use of mineral wool and fiberglass for making his composite boards does not change the fact the resulting product is significantly different. Forming a composite panel from fiberglass does not result in the same product as does forming a wet laid mat from fiberglass fibers. The resulting products are significantly different and not analogous.

Indeed, the product characteristics by which these disparate products are evaluated further highlight their differences. In particular, in the case of the fiber mats of the subject application, the fiber mats are evaluated for their tear strength, along with tensile properties. In contrast, the Belmares' products are evaluated based on using the Modulus of Rupture and Modulus of Elongation measurements for building materials like boards made from mineral fiber, wood fiber, fiberglass, as well as particle board or plywood at high humidity (90 RH). Tear strength is not a property associated with boards and related composite panels.

> **Modulus of Rupture -** Ultimate strength determined in a flexure or torsion test. In a flexure test, modulus of rupture in bending is the maximum fiber stress at failure. In a torsion test, modulus of rupture in torsion is the maximum shear stress in the extreme fiber of a circular member at failure. Alternate terms are flexural strength and Torsional Strength from
> **http://www.instron.com/wa/resourcecenter/glossaryterm**

Belmares also uses a polymeric polyamide in his coating/binder for a fundamentally different purpose than does the present invention. As a consequence of this, Belmares favors using a much larger quantity of the polymeric polyamide, particularly when using a protein, than is used in the mat product embraced by the appealed claims.

In this regard, Belmares specifically describes including a polymeric polyamide as a formaldehyde scavenger in a formaldehyde resin selected from melamine formaldehyde, urea

formaldehyde, phenol formaldehyde and their combinations in such coating or board binder compositions. Belmares polymeric polyamide scavenger may be either a synthetic polyamide or a natural polyamide. Natural polyamides include proteins, such as casein or soy protein. Obviously, only Belmares use of the natural polyamides are relevant to the pending claims.

According to Belmares, the sole purpose of the polymeric polyamide scavenger is to reduce formaldehyde emissions in the coated panels or boards without significantly sacrificing the inherent strength of the panel or board, as occurs when a small molecule scavenger such as urea is used in the coating or binder formulation. "The applied coating with the added scavenger exhibits the same acoustical panel sag performance as one without the scavenger..." page 2, paragraph [0019] of Belmares. There is no disclosure or suggestion that the addition of small quantities of the scavenger significantly improves the strength of the product made in the absence of the scavenger. Belmares contends that this "polymeric" class of scavengers is able to reduce formaldehyde emissions without degrading the strength of the composite board as much as small molecule scavengers do.

In the case of protein polyamide scavengers, Belmares indicates that "the effective range for the protein polymeric scavengers is from about 5% to about 50%, from about 10% to about 40% and from about 20% to about 30% (dry weight of scavenger per dry weight of formaldehyde resin) (page 2, paragraph [0023] of Belmares),

Thus, while Belmares, in its broadest aspect, suggests an addition level in the range of 5 to 50% for its protein formaldehyde scavenger used in the manufacture of panels and boards, Belmares teachings clearly suggest that levels above 10% and especially above 20% are preferred. Consistent with the clear suggestion favoring higher levels of the polyamide scavenger, the polymeric additive and especially the protein additive was used in an amount of 25% (by weight) of the formaldehyde resin in the only specific examples of the invention in Samples 2 and 3 of Belmares illustrative examples. Note that these examples also were limited to the use of a melamine formaldehyde resin. A urea formaldehyde resin (as recited in the appealed claims) was not used. Indeed, in the example presented in paragraphs [0044] through [0046], the use of urea as a scavenger was disparaged.

Belmares failure to describe a wet laid mat and Belmares failure to specifically illustrate an example using less that 10% by weight of a protein additive in the formaldehyde-based resin as a scavenger prevents Belmares from anticipating the claimed invention.

Rejection II is traversed as follows:

Chan does not disclose and does not even suggest that the addition of a protein, let alone only 0.1 to 10% by weight of a protein, to a urea-formaldehyde (UF) resin would have any favorable effect on the strength properties of a wet laid fiber mat made using the modified UF resin as a binder.

Belmares teaches higher levels of protein, than required by the rejected claims, are preferred as a formaldehyde scavenger in Belmares specific application. Belmares teachings do not remedy the shortcoming of Chan's disclosure and thus would not have made it obvious to use what is a significantly lower amount of protein (0.1% to 10% by weight of resin and protein solids in claim 7 and 0.2% to 7% by weight of resin and protein solids in claim 11) in a binder based on a urea-formaldehyde resin for manufacturing a non-woven, wet laid fiber mat.

A skilled worker would not have found it obvious to use protein as an additive in a significantly different application (that is in the manufacture of a wet-laid, non-woven glass mat versus the preparation of a composite board or panel) and at a level of addition below what Belmares prefers and at the lower end of Belmares' broadest taught range, with a reasonable expectation that one would obtain improved strength characteristics in the wet laid mat based on the addition of that small amount of protein to the binder.

The rejection also is improper because Belmares and Chan are not from the same field of endeavor. Indeed, the respective fields of endeavor (composite boards versus wet laid fiber mats) are so disparate that a skilled worker would not have had a reasonable expectation that techniques and compositions relevant to one application would be applicable to the other. Thus, a skilled worker would not consider these teachings in combination.

Chan's invention, like the present invention, is directed to the preparation of a non-woven wet-laid fiber mat. Chan, however, says nothing about protein addition and has no teaching that would in any way suggest that the addition of a protein to a non-woven, wet-laid fiber mat binder

would provide any benefit whatsoever. Chan does show that the addition of a water soluble non-ionic amine oxide (and optionally other polymeric additives) to a UF resin binder used to make wet laid glass fiber mats, improves the tear strength of the mat and can improve tensile properties of the mat.

As explained above, Belmares is directed to panel and board products – products that are fundamentally different from the wet laid glass mats made by Chan.

The Office Action apparently combines the disclosure of Chan and Belmares on the basis that they "are from the same field of endeavor, (i.e., glass fiber mats bound by formaldehyde-based resins)." As discussed above, Chan and Belmares are NOT from the same field of endeavor and are not analogous. Teachings of Belmares related to boards and composite panels are not directly applicable to the manufacture of a wet laid mat, the technology of Chan and of the present invention. There references are not from analogous fields.

The Office Action alleges further support for the combination by arguing that "[t]he skilled artisan would have been motivated by the desire to reduce the amount of formaldehyde emitted by the fibrous article [in Chan]."

In making such a combination, it difficult to understand why a skilled worker would seek to either replace the optionally fortified amine oxide additive used in Chan's binder with the polyamide scavenger (protein) of Belmares, or alternatively would simply add the scavenger to the Chan formulation. On the one hand, Chan does not indicate there is any formaldehyde emission problem with his formulation. In the absence of hindsight then, what is the motivation to add the protein as an additonal additive in Chan's invention? Why is there any need to scavenge formaldehyde in Chan's invention? Chan does not suggest there is any need. On the other hand, obtaining improved tear and tensile properties are Chan's objective and focus and there is no way of knowing whether or not the addition of the protein in combination with Chan's amine oxide and other components would impair the resulting tensile properties of Chan's mat. Belmares disclosure relating to radically different products does not answer those questions. The proffered combination simply does not provide a skilled worker with a

reasonable expectation of a favorable result, thus the combination fails as a sustainable rejection under 35 USC 103.

Testing results presented in the subject application also support the patentability of the pending claims. U.S. Patents 5,914,365 and 6,084,021 are directed to the preparation of non-woven wet-laid fiber mats, just as is the present invention. While these patents do not have any teaching that would in any way suggest that the addition of protein to a non-woven, wet-laid fiber mat binder would provide any benefit whatsoever, these patents do show that the addition of a small amount of SMA copolymer to a UF resin binder, conventionally used to make glass fiber mats, significantly improves the tear strength and the Dry and Hot-wet tensile properties of the mat relative to a mat prepared with the non-SMA modified UF binder resin. In particular, the data reported in Tables 1A, 1B, 1C, 1D, 1E, 2, 3, 4 and 5 of these patents show a consistent pattern that the addition of as little as 0.1% SMA to the UF resin binder provides a measurable improvement in the tear strength and tensile properties of the glass mats. Indeed, that showing was the basis on which the Chang patents were granted.

Data in Tables 1, 2 and 3 of the subject application, in turn, demonstrate that a minor level of protein addition to a UF binder resin can replace all or a part of the SMA additive with equivalent strength results for the mat. Thus, when the showing from the Chang patents (that a binder based on SMA plus a conventional UF resin provides unexpectedly superior mat strength properties versus a binder based on a conventional UF resin alone) is coupled with the data presented in the subject application (showing that a binder having a minor level of protein addition to a UF binder resin can replace all or a part of the SMA additive with equivalent strength results for the mat), a skilled worker readily recognizes that the addition of a small amount of soy protein to a binder comprising a conventional UF resin results in unexpectedly superior mat strength properties versus a binder based on a conventional UF resin alone. Such strength improvements are not disclosed or suggested by the prior art.

Rejection III is traversed as follows:

Trocino describes making a protein-based adhesive by functionalizing a denatured (hydrolyzed) vegetable protein with methylol groups (e.g., treat the protein with formaldehyde), and then reacting the functionalized protein with a co-monomer having methylol groups (e.g., dimethylolurea or dimethylolphenol). Like Belmares, Trocino uses the adhesive in the formation of composite boards. Unlike Belmares, Trocino uses the functionalized soy component as the major constituent of the binder (in the examples the soy additive was 50% or more of the adhesive solids). Surely, the level at which the soy additive is used in Trocino's binder is far removed from the upper limit (10%) for protein usage in the wet laid fiber mat binder embraced by the pending claims, such that Trocino does not remedy any of the deficiencies of Belmares.

The rejection relying in part on Trocino also fails to provide an appropriate basis for combining the references. In Belmares, the protein is added solely as a formaldehyde scavenger. In Trocino, the protein is the main structural constituent of the adhesive formulation. A skilled worker would not consider the teachings of Trocino in connection with Belmares. The only similarity between the two is that they both relate to the making of composite boards. However, this similarity constitutes one of the main distinctions between these references and the pending claims. As noted above, a skilled worker would not consider teachings directed to composite panels and boards to have any relevance for non-woven, wet laid fiber mats. Trocino also is a non-analogous reference vis-à-vis the claimed invention.

Indeed, it is this fundamental distinction between the Belmares and Trocino references on the one hand, and the Chan reference and the present invention on the other hand, that the Office Action has erroneously ignored. While Belmares and Trocino describe the construction of fiberboard panels, Chan and the present invention do not. Chan and the present invention describe the preparation of wet laid mats. These products are not the same and they are not analogous.

Conclusion

Based on the cited references, a skilled worker would not have found it obvious to use protein as an additive for a UF resin binder in wet-laid, non-woven glass mat, particularly at a level of addition required by the claims which is well below what Belmares prefers in connection with the preparation of composite boards, with a reasonable expectation that one would obtain improved strength characteristics in the wet laid mat based on the addition of that small amount of protein

For these reasons, the rejections of claims 7-13 should be reversed.

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Respectfully submitted,

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